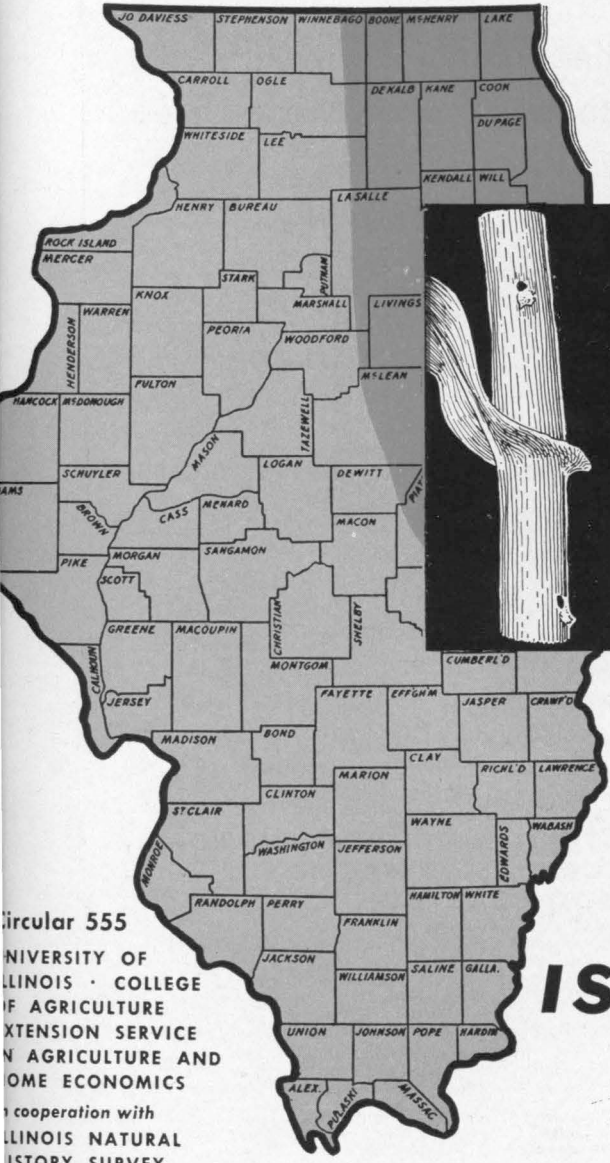
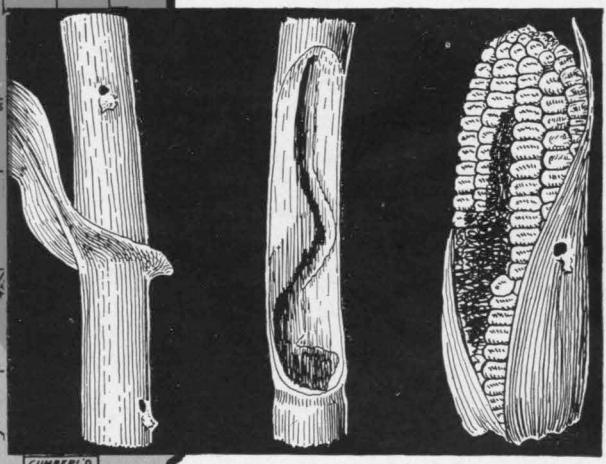
CORN-BORER SITUATION 1943





ENTIRE STATE IS INFESTED

Circular 555
UNIVERSITY OF ILLINOIS · COLLEGE OF AGRICULTURE
EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS
In cooperation with
ILLINOIS NATURAL HISTORY SURVEY

ONLY VIGOROUS CONTROL WILL KEEP UP CORN YIELDS

LOSSES CAN BE SHARPLY REDUCED . . .

without adding much, if anything, to production costs. Follow these three simple practices—

- *Use best adapted resistant hybrids*
- *Avoid early planting on highly fertile soils*

  This does not mean to plant late. It means to plant during middle or latter part of the usual planting period.

- *Practice clean farming*

  Plow under as completely as possible all corn-stalks and plant refuse before May 1.

IF NO STEPS ARE TAKEN TO COMBAT THE BORER, ILLINOIS CORN YIELDS MAY BE CUT 25 TO 50 PERCENT

(This circular is a revision of Circular 521, *Corn-Borer Control,* issued in January, 1942)

Urbana, Illinois May, 1943

Cooperative Extension Work in Agriculture and Home Economics: University of Illinois, College of Agriculture, and the United States Department of Agriculture cooperating. H. P. Rusk, *Director.* Acts approved by Congress May 8 and June 30, 1914.

CORN-BORER SITUATION 1943

Prepared jointly by the ILLINOIS STATE NATURAL HISTORY SURVEY and the DEPARTMENTS OF AGRONOMY and AGRICULTURAL ENGINEERING of the ILLINOIS AGRICULTURAL EXPERIMENT STATION[1]

THE EUROPEAN CORN BORER increased more rapidly in Illinois in 1942 than it has in any similar area in the United States since it became established in this country. There were more borers in some of the northwestern counties in January, 1943, than there were on the east side of the state a year earlier. Over the entire area of some of the eastern counties the number of borers in hibernation runs as high as 15,000 to 24,000 an acre of cornstalks.[2]

Farmers in Indiana and Ohio, who have had many years of experience with the single-generation borer, are producing good crops of corn in spite of it. By consistently following the practices outlined in this circular, growers in the most fertile corn-producing areas of Ohio produced 60 to 100 bushels of corn to the acre in 1942. Those who neglected any of these practices, especially where they failed to plant best adapted and most resistant hybrids or where they planted their corn too early, found their yields cut in half and the corn was of poor quality.

On experimental plots in areas in Ohio where the borer has been a pest for fifteen to twenty years, these practices have made it possible to harvest consistently high yields on highly fertile soils.

Sweet corn was commercially damaged in a number of areas in eastern Illinois in 1942. In this same area the borer cut the yields of field corn about 2 bushels an acre.

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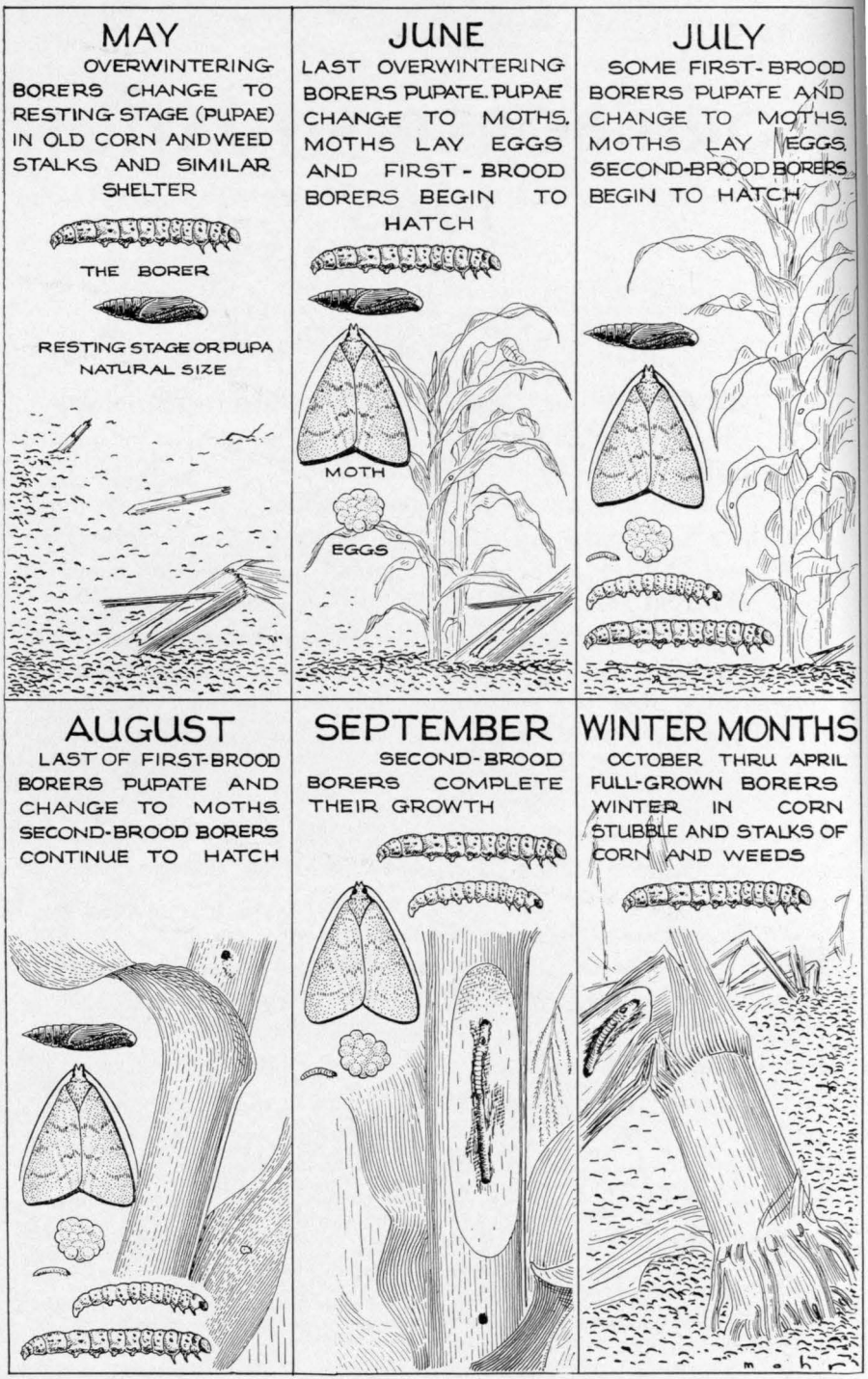
[1]Joint action by research workers in many different fields is necessary for the solution of the farming problems caused by the advent of the European corn borer. The following members of the above staffs are participating in the investigations in Illinois: *In the Illinois State Natural History Survey*—W. P. FLINT, Chief Entomologist (also Chief Entomologist in the Experiment Station); J. H. BIGGER, Associate Entomologist; J. W. APPLE, Field Entomologist. The drawings are the work of C. O. MOHR, Associate Entomologist. *In the Agricultural Experiment Station*—G. H. DUNGAN, Chief in Crop Production; A. L. YOUNG, Associate Chief in Agricultural Engineering; C. M. WOODWORTH, Chief in Plant Genetics, and A. L. LANG, Assistant Chief in Soil Experiment Fields.

[2]Altho borers were found within 25 miles of Illinois in 1930, it was not until 1939 that they were actually discovered in the state. Five northeastern counties were then found infested. In 1940 12 more counties were added to the infested list, and in 1941 26 more counties.



The shorter the corn plants are at the peak of moth flight (usually in June) the less likely are the moths to deposit eggs on them. That is why delayed planting reduces injury by first-generation moths. ("Brood" as used above means generation.)

Two Generations a Year in Illinois

The life cycle of the corn borer in Illinois is proving different from what it is in Ohio. Seventy to 80 percent of the borers are producing two generations a year, instead of only one. This will probably continue to be the case, according to all present indications. In fact in southern Illinois the insect is almost certain to produce three generations a year when it becomes well established there.

With two generations a year the life cycle of the borer will be approximately as shown on page 4 and described here:

May. The borers, which have overwintered in the stems of plants, change to the pupal (brown resting) stage.

June. First-generation moths emerge from the pupal stage and lay their eggs, the heaviest part of the egg-laying period coming during the latter part of June. These moths choose the tallest, most rapidly growing corn on which to lay their eggs. Borers will be found in all stages this month.

July. First-generation borers are becoming full grown and changing to the pupal stage. There are fewer moths in flight than in June altho some eggs are being laid. Second-generation borers are beginning to hatch. The borer will be found in all its stages this month also.

August-October. Heavy flight of second-generation moths comes in August, especially the latter part, and continues into September and even into October. By mid-September the oldest of the second-generation borers are full-grown and nearly all will complete their growth during October. The borers go into the winter in the worm stage and in that stage only. They bore into the stems of plants, particularly cornstalks and large weeds, and thus protected they pass thru the winter. When warm weather returns in the spring they are ready to develop into the pupal (brown resting) stage and start the life cycle over again.

Some Promising Inbreds and Hybrids

Distinct and consistent differences exist among the various inbreds, single crosses, hybrids, and open-pollinated varieties of corn in their resistance to borer damage. That some strains are only lightly damaged has been shown by tests carried on for fifteen years in Ohio. The differences appear as variations in (**1**) the attractiveness of the corn plant to the moth of the borer, (**2**) the ability of the borers to establish themselves in the plant and survive there, and (**3**) the ability of the plant, even tho infested, to produce a good yield of marketable corn.

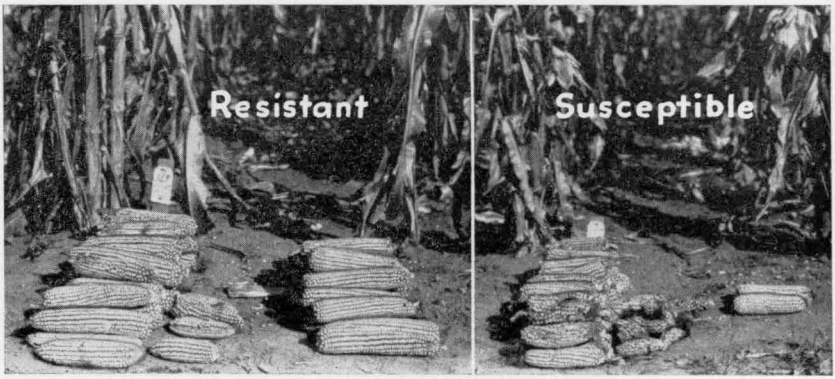
But the borer in Ohio, where these tests have been made, has produced mainly one generation a year. The question for Illinois is how well different strains of corn will resist two generations a year.

Hybrids tentatively recommended. Until the Illinois corn crop has been exposed to the two-generation borer for several years, the above question—how well different strains of corn will resist attack—cannot be conclusively answered. Some light is thrown on the question,

however, by one year's test at Wichert in Kankakee county. The following hybrids withstood the 1942 attack and came thru with satisfactory yields:

U. S. 13: (WF9 × 38-11) (Hy × L317)
Ohio L86: (28 × L317) × Hy
Illinois 374: (R4 × Hy) (187-2 × L317)
Illinois 960: (R4 × Hy) (701 × L317)
Illinois 972: (WF9 × Hy) (701 × L317)

Even tho these hybrids may be resistant to the corn borer, they are not, of course, recommended for areas outside their range of climatic and soil adaptation. In fact, now that the corn borer has become well



Breeding for borer resistance made this difference. Grown side by side, the susceptible strain produced only 2 good ears besides a small number of damaged ears; whereas the resistant strain yielded many good ears and only a few badly damaged ones.

established in Illinois, a hybrid entitled to be classed as "adapted" must be both resistant to this pest and suited to the climate and soil.

Tentative classification of inbreds. Commercial corn breeders are interested in the work with inbred lines and single crosses which the Illinois Station has been doing both in Ohio for fifteen years (1928-1942) and in Illinois in 1942. As a result of these tests certain inbreds now being used in the Illinois corn-breeding program may be tentatively classified as follows with respect to resistance and susceptibility to the single-generation borer. Indications are that these lines will react to the first-generation borer in Illinois in the same manner as they have to the single-generation strain in Ohio.

Resistant

Illinois R4	Iowa L317	Ohio O7
Illinois Hy	Wisconsin CC5	Iowa I205

Partially resistant

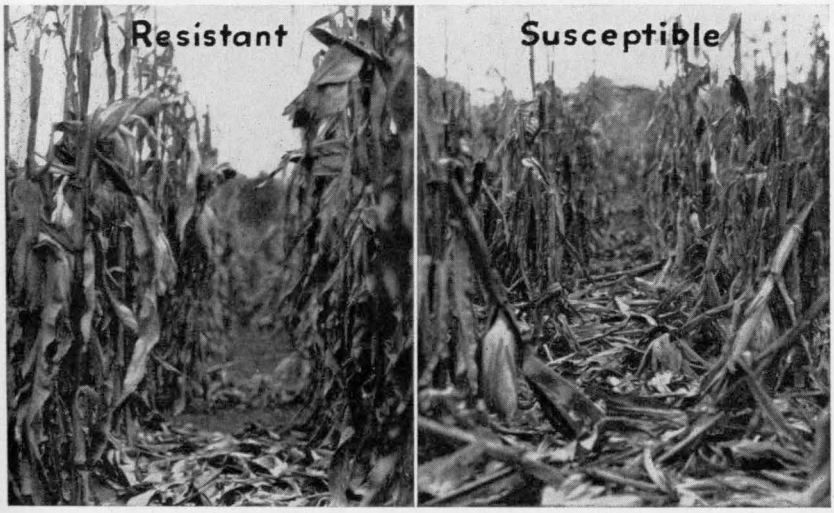
Indiana 38-11	Kansas Kys	U.S. 540
Iowa 701	Kansas K4	Iowa I159L1
Wisconsin CC7	Wisconsin CC1	Ohio 28

Susceptible

Illinois A	Indiana WF9	U.S. 4-8
Illinois 90	Indiana Tr	U.S. 187-2
Illinois M14	Iowa OS420	
Illinois 5120	Iowa Kr(Osf)	

Some inbred lines appear to give hybrids more resistance to borers than would be expected on the basis of the above classification. Others appear to contribute less resistance than would be expected. Indiana WF9 and U.S. 187-2, for example, are classed as susceptible to borer attack as inbreds. Nevertheless WF9 contributes strong stalks to single crosses, with the result that these crosses show considerable tolerance to borer attack. Line 187-2, tho susceptible as an inbred, apparently contributes some inherent factors for resistance to the hybrids in which it is used. On the other hand, because of lateness or some other inherent factor, single crosses involving Iowa L317, classed as resistant, did not withstand the attack of second-generation borers in 1942 as well as some other crosses.

Improved strains of inbred lines are being developed by the Illinois Station and will be tested under Illinois corn-borer conditions.



The upstanding stalks at the left show what can be expected of a resistant strain. Only very little breakage occurred. The broken stalks at the right are typical of susceptible strains under corn-borer attack.

Effect of Time of Planting

On highly productive or fertilized soils corn planted as late as May 12 to 20 in central Illinois will escape much of the first-generation infestation of corn borers and still have time to mature a normal crop in most seasons. These moths, flying in large numbers in late June, choose the tallest, most rapidly growing corn on which to lay their

Fertilizer caused marked increase in height of early-planted corn by July 2, when late first-generation moths were seeking tall plants on which to lay their eggs (*Wichert field, Kankakee county, 1942*).

eggs. This is true whether the area is a one-generation area or a two-generation area. The later-planted corn will not be tall enough in June to attract these moths.

Late planting will not prevent infestation by second-generation borers, most of which hatch in August. In fact, *very* late planting may be even worse than early planting because corn planted late will be at a stage more attractive to borer moths at the time when the second-generation moths are in flight and will not be sturdy enough to resist attack, as will corn planted moderately late. However, when August is dry, the second-generation borers may not cause heavy damage.

In heavily infested areas slightly earlier-maturing hybrids are recommended for delayed planting, but these hybrids should not be used unless they are well adapted to the soil and climatic conditions of these

areas. They should be planted somewhat thicker than the later-maturing kinds in order to make up for their smaller size. Every effort should be made to obtain good stands.

On soils of low productivity there is no need to delay planting in order to prevent borer damage, for the borers are not attracted to corn on these soils in serious numbers.

CORN-BORER INFESTATION AND DAMAGE TO COMMERCIAL CROSSES AT WICHERT, KANKAKEE COUNTY, ILLINOIS, 1942

	CORN PLANTED MAY 4		CORN PLANTED MAY 25	
	Not fertilized	Fertilized	Not fertilized	Fertilized
Conditions July 2-20, showing damage by first-generation borers				
Height of plants (inches)	37	48	26	31
Leaf damage rating 0-4[a]	1.2	2.4	.4	.9
Percent of plants infested	41	74	12	30
Conditions October 5-17, showing damage by first and second generations				
Borers per plant	3.9	3.6	5.4	4.7
Percent of plants broken below ear	12.7	16.3	13.3	13.3
Percent of ears showing damage at harvest	1.1	1.4	.7	.9

[a]0 = no damage, 4 = greatest damage observed.

The first-generation borers did more damage to the plants in the test than did the second generation. Extremely early and extremely late planting dates were used in order to measure the effect of borers on plants in different stages of maturity.

Fertilizers Cut Second-Generation Damage

The 1942 tests in Kankakee county indicate that corn planted the middle of May on very productive soil or on well-fertilized soil will not only escape a high percentage of first-generation borers because it is not tall enough to attract them, but will also grow large enough and develop enough sturdiness by the time the second-generation borers arrive to provide some resistance to attack by that generation.[1]

The number of *second-generation* larvae per plant in both the early and the late plantings in the 1942 tests was less on fertilized soil than on unfertilized soil. Fertilization gave protection from second-generation attack by producing sturdier plants better able to resist attack. It also resulted in better corn by reducing the moisture at husking time.

First-generation borers during July were found in 74 percent of the plants in the early-planted section of the fertilized plots, whereas only

[1]Parts of the corn-borer experimental plot at Wichert in Kankakee county were fertilized in 1942 in order to study the effect of early growth, stalk sturdiness, and maturity changes on corn-borer population, damage, and tolerance.

41 percent of the plants in the adjoining unfertilized plots were infested, demonstrating the way in which the more advanced corn suffers in July from borer attack (*see table, page 9*).

Plowing Is Best Clean-Up Method

The most economical and effective way to destroy borers is to plow under all stalks and other plant material in infested fields. The material must be buried deep enough so that none will be brought up in later operations. Even tho some borers will work their way up to the surface, few will survive where there is no plant material into which they can crawl for shelter. In order to bury *all* stalks, plowing must be very well done.

If plowing under stalks and other clean-up methods are to be commercially worth while, they must be applied to all infested fields over a large area, for the moths will fly from one field to another.

Certain crop uses aid clean-up. Sometimes a crop can be so used that most of the borers will be killed without other effort. Low cutting of stalks (followed by ensiling or shredding), and cattle tramping the stalks into the manure where the stalks are being fed, are two ways to destroy borers while making use of the crop. Some farmers who have had experience in heavily infested areas argue that in livestock sections more corn should be cut low, placed in shock, and later shredded for both feed and bedding, rather than husked from standing stalks. This would also largely solve the problem of saving the straw from the combine for bedding.

Burning not recommended. If neither feeding the stalks nor plowing them under is practical, the infested material can be burned, but burning is not a good practice. This is true because (1) raking does not do a perfect job of collecting the stalks, so not all of them are burned, and (2) burning destroys organic matter valuable to the soil. However, burning is sometimes resorted to when another crop is to be seeded on ground that has not been plowed.

To Get Good Trash Coverage

Ordinary plowing does little to help control corn borers because it leaves too much material on the surface. Most farmers can get good coverage, however, with their moldboard plows by keeping them in better condition, equipping them with needed attachments, and using more care in operating them. Plow bottoms should be the proper size, should be suited to the soil, to the speed of plowing and the power available, and the moldboard should scour readily.

Keep plow in good condition. Shares should be sharp and

pointed, and the rolling colter should be sharp enough, large enough, and so set that it will cut thru all trash and leave a clean furrow wall. The hitch must be approximately correct both vertically and hori-

Adequate plow attachments are necessary to do a job like that on the left. Blame for the poor coverage at the right can be laid to lack of the right attachments. The same plow was used on both areas and was run at the same depth.

zontally.[1] Any badly worn part that keeps the plow from doing a good job should be repaired immediately.

Use special attachments. For good trash coverage some additional equipment will generally be needed. Use moldboard-type or disk-type jointers, and adjust them carefully. Jointers of the moldboard type are often combined with the colter but if preferred can be separately mounted on the beams. Unfortunately, wear at the point of the moldboard jointer often causes trash to lodge between the jointer and the colter. It is sometimes necessary to reshape the point in a forge in order to prevent this lodging.

Either wires or trash shields are also usually needed. They flatten and hold down the trash and force it into the bottom of the open furrow. Many farmers are now using one or more wires to a bottom, commonly No. 9 size and about 10 feet long. These wires should be held rigid at the point of attachment. Trash shields have not been used extensively in Illinois but have been satisfactory in Indiana, according to the Purdue Station. Constructed of sheet metal and hinged above each moldboard, these shields must be carefully shaped and fitted.

[1]Write the COLLEGE OF AGRICULTURE, Urbana, for Circular 450, "Better Plowing," which thoroly discusses plow adjustments. Copy will be sent free.

A different plan of shield is needed for each type and model of plow. Some of the older plows may not have enough clearance beneath and between beams to provide space for needed attachments and still let large amounts of trash pass freely.

Work field before plowing. Complete coverage of cornstalks is sometimes more easily obtained if fields are given thoro disking before they are plowed. Double-disking is especially recommended where the ground is considerably ridged. If possible, the fields should be disked early because a rain between disking and plowing is often helpful in obtaining complete coverage.

In machine-picked fields where stalks are to be plowed under without first being disked, the ground should be plowed in the same direction that the picker was driven. The need to do this should be considered when plans for corn picking are being made in the fall.

Insecticides Protect Sweet Corn

Insecticides are the only means of protecting early and late sweet corn from the corn borer, for there is little information yet about resistant sweet-corn varieties and delayed planting is not practicable since sweet corn must mature thruout the marketing season. Cost of treatment is fairly high but will be profitable to market gardeners in most Illinois localities where the borers threaten to destroy as much as 25 percent of the marketable crop.

Dusting or spraying with nicotine or rotenone has given the best results. Either material must be applied four or five times—first when the borers begin to hatch and later at five-day intervals. For specific directions on dusting and spraying, write the ILLINOIS AGRICULTURAL EXPERIMENT STATION or the ILLINOIS STATE NATURAL HISTORY SURVEY, Urbana.

Growers in heavily infested areas of Illinois who plant sweet corn early on soil that is heavily fertilized should be prepared to protect their fields with insecticides. Otherwise their crops are likely to be completely destroyed. This is especially true for April plantings in northeastern Illinois. It is also true for late June plantings thruout the state. However, plantings in central Illinois about May 5 to June 5, judging from experience in 1942, will be only moderately infested.

THE DEVELOPMENT OF TWO GENERATIONS OF CORN borers in a season in Illinois has created new problems but has not changed the essential character of the control methods (see page 2).

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